

CMSC 341 Data Structures

General Tree Review

March 21, 2005

These questions are intended to assist you when studying for the exams. They are by no means a comprehensive set of all possible exam questions.

1 General Trees

1. Define *tree*
2. Define *k-ary tree*
3. For any tree, T , define the following
 - (a) path in T
 - (b) length of a path in T
 - (c) height of a node in T
 - (d) depth of a node in T
 - (e) height of T
 - (f) depth of T
 - (g) external node
 - (h) internal node
 - (i) leaf
4. Given the drawing of an arbitrary tree, draw the first-child, next-sibling representation of the tree
5. Given the first-child, next-sibling representation of a tree, draw the tree.
6. Prove that there are $n - 1$ edges in any tree with n nodes
7. What is the worst-case big-O performance for the insert, find and remove operations in a general tree? Why is this so?
8. Write a recursive member function of the “static K-ary” tree class that counts the number of nodes in the tree.

2 Binary Trees

1. Define *binary tree*, *full* binary tree, *complete* binary tree and *perfect* binary tree.
2. Define internal path length and external path length
3. Prove that a perfect binary tree of height h has 2^h leaf nodes.
4. Prove that a perfect binary tree of height h has $2^{h+1} - 1$ nodes.
5. Prove that a full binary tree with n internal nodes has $n + 1$ leaf nodes.
6. Prove that in any binary tree with n nodes there are $n + 1$ “null pointers”.
7. Suppose you have the following two traversals from the same binary tree.
Draw the tree
pre-order: A D F G H K L P Q R W Z
in-order: G F H K D L A W R Q P Z
8. Write a recursive member function of the BinaryTree class that counts the number of nodes in the tree.
9. Write a recursive member function of the BinaryTree class that counts the number of leaves in the tree.

10. Given the following binary tree containing integers, list the output from a *pre-order traversal*, an *in-order traversal*, a *post-order traversal* and a *level-order traversal* of the tree.

